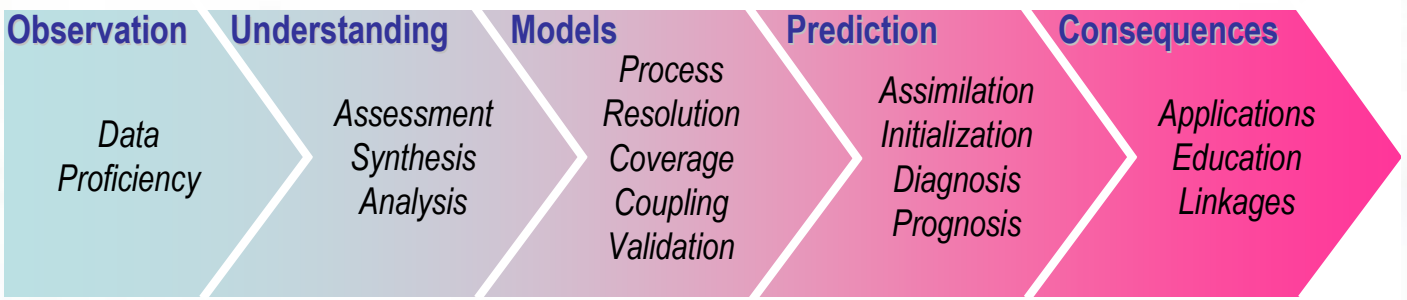
Observations

Eni Njoku and Bing Lin



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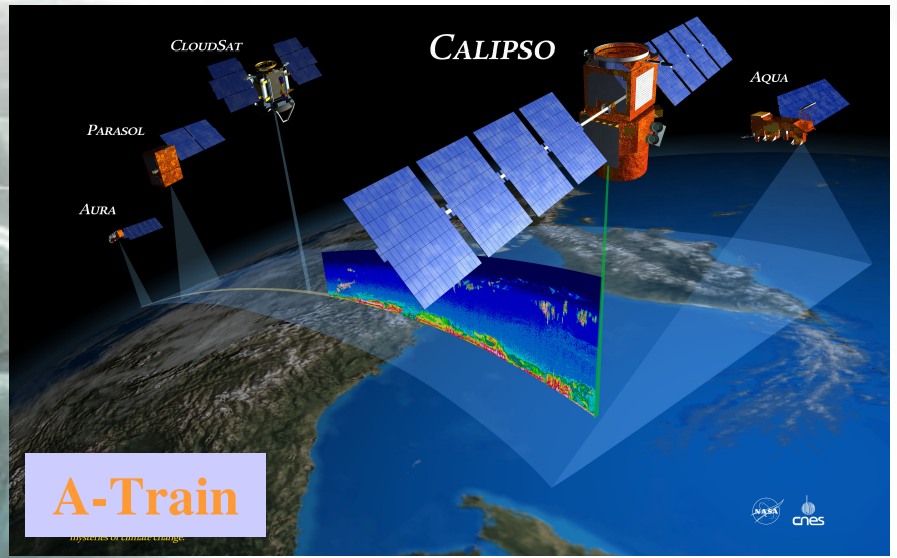


- Satellites can accurately monitor many aspects of the Earth system on a global scale, including the evolution and impacts of the El Nino, weather phenomena (particularly clouds and precipitation), natural hazards and extreme events such as floods and droughts, vegetation cycles, the ozone hole, solar fluctuations, changes in snow cover, sea ice and ice sheets, and others.

- For water and energy cycle research, among the most significant gaps are global observations of land surface hydrology parameters such as soil moisture and ground water storage, soil freezing and thawing, surface water reservoirs and river discharge.

- Also needed are surface-based, and in-situ observations for determining geophysical variables that cannot directly be measured from space and for the calibration and validation of long-term records of satellite-derived geophysical, chemical and biological quantities.

- Historically, operational space-based observations were disparate, not well-calibrated nor uniformly processed, and not assembled into a consistent long-term record of global scale phenomena.

- Several recent efforts have been directed at re-processing long-term records of operational satellite data using new retrieval algorithms, e.g., derivation of time series of precipitation estimates by applying TRMM retrieval algorithms to historical SSM/I microwave observations.

Calibration, long-term measurement, and data fusion

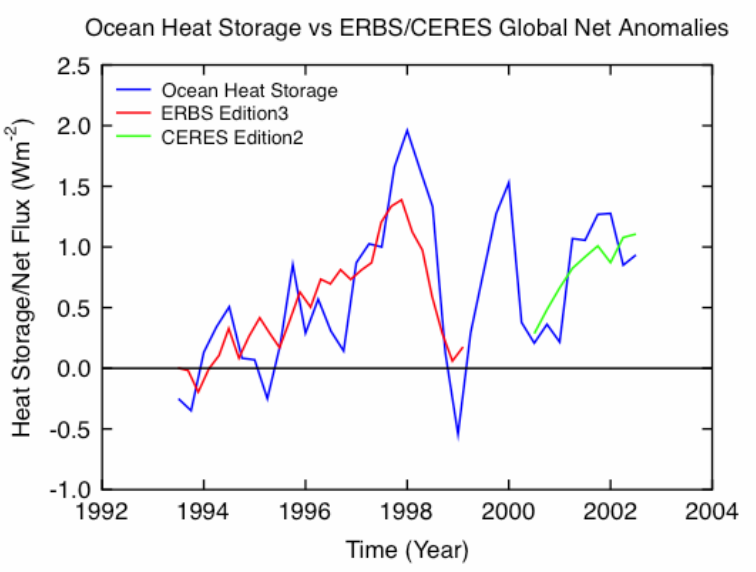
- Experimental/research satellites are typically aimed at measuring specific components and/or processes of the global energy and water cycles, over a relatively short period of time – in a climatological perspective.

- While measurement systems scheduled for the near future will fill in critical observational gaps or improve current observational capabilities, only incomplete provisions are being made for high quality measurements of some essential climate variables; notably ocean surface winds (the curl of the wind stress determines ocean up-welling and heat transport to the air-sea interface)

  - This may require collecting data from an ad-hoc succession of diverse satellite measurements and appropriate data analysis methods to ensure long-term consistency.

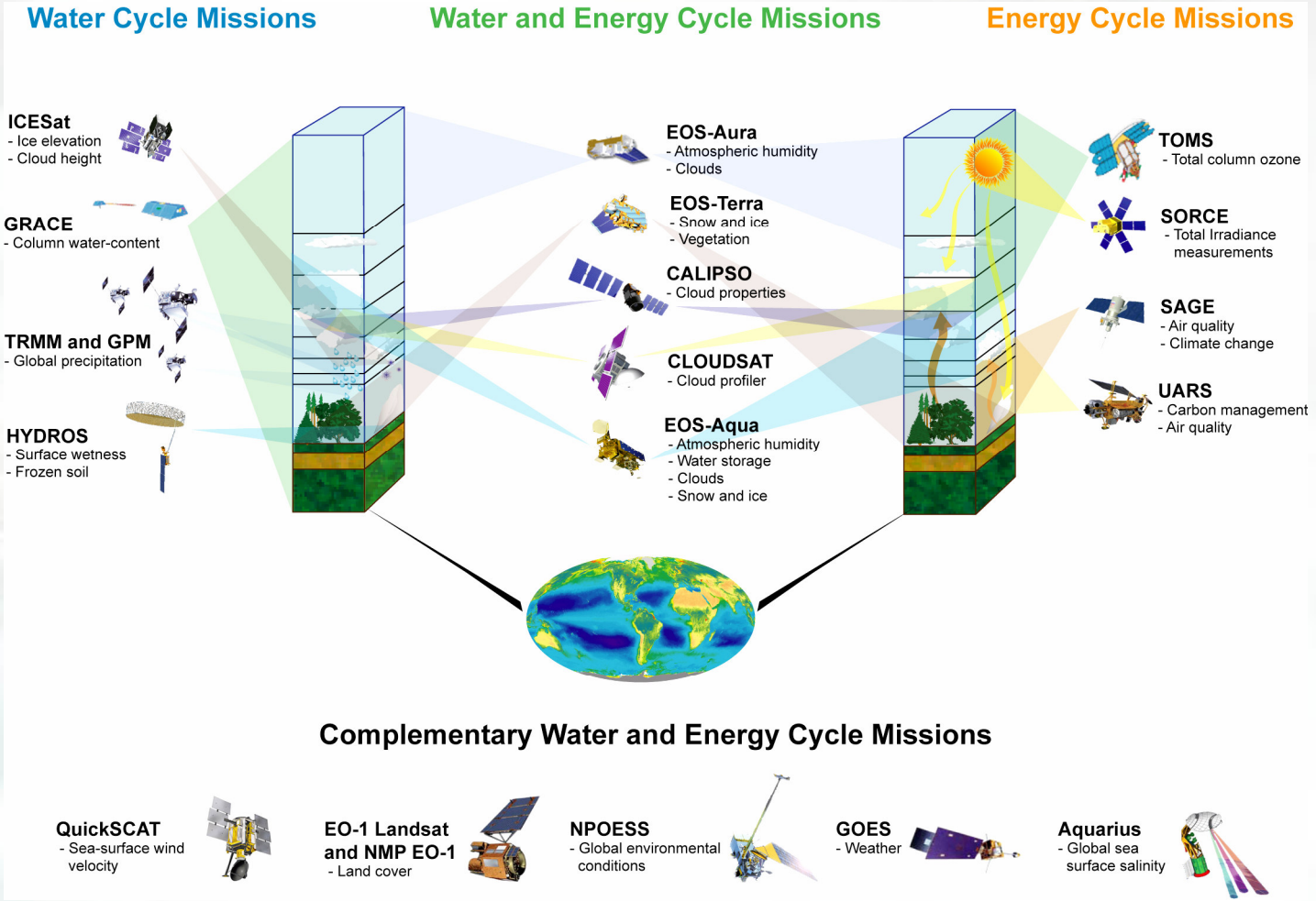
- Inferring reliable climatological records of variables and trends in the global energy and water cycle from multiple space and surface based observing systems remains a research challenge, even for basic quantities such as rainfall.

- A substantial long-term effort is required to periodically reanalyze the complete collection of satellite data with improved retrieval algorithms, and to develop the means for satellite sensor inter-calibrations.



Spacecraft

- In terms of current and pending missions, an orbiting fleet of eighteen NASA research satellites provides relevant energy and water-cycle observations



NEWS Satellite/Instrument Roadmap